REMARKS

Claims 1-40 are currently pending in the subject application, and are presently under consideration. Claims 1-40 are rejected. Claims 1, 16, 21, 27, 31 and 34 have been amended. Favorable reconsideration of the application is requested in view of the amendments and comments herein.

I. Amendment to the Specification

The Related Applications section of the present application has been amended to replace the identified attorney docket numbers with the application serial numbers.

II. Rejection of Claims 1-9, 12-14, 16-22, 25-29, 31-37 and 39-40 under 35 U.S.C. 102(b)

Claims 1-9, 12-14, 16-22, 25-29, 31-37 and 39-40 have been rejected under 35 U.S.C. 102(b) as being anticipated by U.S. Patent Application No. 2002/0129211 to Arimilli, et al ("Arimilli"). Applicant traverses this rejection for the following reasons.

Claim 1 has been amended to recite that which was already implicit; namely, that the ownership data response comprises a copy of the data. The Office Action contends that Arimilli discloses the system of claim 1. We disagree with this contention. The system of Arimilli fails to teach a first node that provides a source broadcast request for data. Contrary to the characterization of Arimilli in the Office Action, Arimilli as a whole teaches a data processing system and method for resolving a conflict between requests to modify a shared cache line. See Abstract, lines 1 to 5. That is, the approach in Arimilli at para. [0035]-[0038] (in describing FIGS. 3A and 3B) and in Arimilli, more generally, relates to how conflicts between requests of multiple agents to modify a target cache line in a shared state are arbitrated by the coherency decision point (CDP) and how ownership of the cache line granted by the CDP is protected. See Arimilli at para. [0034].

The particular reliance on para. [0036] relating to the "master 26 preventing access to the target cache line by other agents...until the store in the cache array is completed"

similarly appears misplaced. Reference to para. [0036] demonstrates a particular scenario in which the cache line has the modified or exclusive state in which the "master 26 simply performs the store into cache array 24 without issuing a transaction on the system bus and, if appropriate, updates cache directory 22." Arimilli at para. [0036]. Accordingly, such section of Arimilli and its teaching of preventing access to the target cache line does not involve any source broadcast request for data, as recited in claim 1. Instead, the data is already in a modified or exclusive state in cache of the agent issuing the transaction. Arimilli at para. [0036]. The remaining sections of Arimilli cited in the Office ACtion and Arimilli, more generally, relate to other specific scenarios when the target cache line is held by the cache 14 in a shared state or a shared-owner state, such that, again, there would be no reason to issue a source broadcast request for the data since such data is already at the master that issues the transaction. See Arimilli at para. [0037]-[0038].

Moreover, at para. [0012], Arimilli teaches that while data associated with a target address "are cached at a first agent among the plurality of agents in a shared state, the first agent issues a transaction on the interconnect." Since the first agent of Arimilli already has the data cached, such first agent would not issue a source broadcast request for data already in its cache. This is supported by the teaching of Arimilli in which the CDP provides a snoop response granting the first agent ownership of the data that is already cached at the first agent. Arimilli at page 2, para. [0012].

Claim 1 recites that the first mode can respond in a first manner while the source broadcast request for the data is pending at the first node and in a second manner in response to receiving an ownership data response. Applicant submits that the cited sections of Arimilli in the Office Action and Arimilli, more generally, do not teach the first and second manners of responding, as recited in claim 1.

Arimilli fails to teach that the first node is operable to respond other source broadcast requests for the data while the transaction is pending. Instead, Arimilli explicitly states that the CDP - NOT the first agent - protects the grant of ownership until the combined response is received by the first agent. See para. [0013]. It is only after the first agent receives the combined response granting ownership of the target cache line that the first agent can assume responsibility for protecting its ownership of the data. See, for example, para. [0033] which explains why the CDP and not the agent itself provides responses to deny ownership to other agents that issue conflicting transactions.

Significantly, Arimilli fails to teach that an ownership data response is received at a first agent, as recited in claim 1. In contrast to claim 1, Arimilli teaches that CDP provides a snoop response "granting ownership" to the already cached line of data of the first agent. See Arimilli para [0012], and [0034] to [0038]. This snoop response is not a "data response" as would be understood by one of ordinary skill of the art and as such term is consistently used in the present application and as recited in amended claim 1. In particular, amended claim 1 recites that an ownership data response includes a copy of the data. See also para. [0047] of the present application for examples of data responses. Again, this difference in the teaching of Arimilli from what is recited in claim 1 are revealed when considering the purpose of Arimilli, which is to arbitrate between conflicting requests to modify data cached in a shared state. See Abstract of Arimilli. As a consequence of Arimilli failing to disclose that an ownership data response is received at the first node, there is no basis to conclude that the first agent in the system of Arimilli would respond in the second manner, as recited in claim 1.

Applicant further submits that the Office Action appears to combine selected teachings from Arimilli in a manner to purportedly find support for rejecting claimed subject matter, in a way that would not be enabling to one of ordinary skill in the art. However, upon

reading Arimilli in its intended context, as discussed above, it becomes evident that Arimilli contains no teaching (or even any suggestion) of the system recited in claim 1.

For the reasons stated above, Arimilli fails to teach each and every element of claim 1. Accordingly, Applicant respectfully requests reconsideration and allowance of claim 1, as well as claims 2-15 that depend from claim 1.

Regarding claim 2, Arimilli fails to teach that the ownership data response comprises an indication to the first node (*e.g.*, which issued the source broadcast request) that the data associated with the ownership data response comprises migratory data, as recited in claim 2. The Office Action appears to fail to appreciate what is being described in Arimilli as it relies on a section of Arimilli that describes the master initiating a DCLAIM transaction on the system bus. However, Arimilli states that "an agent issuing a DCLAIM is not requesting a copy of the target cache line," (Arimilli at para. [0007]) but instead refers to transaction in which the master intends to modify a shared cache line held in its associated cache. See Arimilli at para. [0037]. That is, since the master already has the shared cache line in its own cache, there would be no indication in the ownership response provided by the CDP that such response would comprise migratory data. Instead, as discussed above, Arimilli teaches that the data does not migrate when a master issues a DCLAIM transaction. Since Arimilli fails to teach claim 2, Applicant respectfully requests reconsideration and allowance of claim 2.

Claim 3 depends from claim 2, and introduces the concept that the migratory data comprises a cache ordering point for serializing source broadcast request for the data. In rejecting claim 1, the Office Action states that the CDP provides a snoop response to grant the first agent ownership of the data. See Office Action, at page 4, last sentence of numbered para. 9. The rejection of claim 3, however, fails to address the concept of a cache ordering point and its migration, as recited in claim 3, but instead erroneously focuses on non-data clean-up transactions and responses as described in Arimilli in the context of when the target

cache line is exists in the shared-owner state. However, nothing in the cited para. [0038] of or elsewhere in Arimilli teaches or even suggests the recited cache ordering point migration in which the ordering point migrates to the first node (which provided the source broadcast request for the data) from a node that provided the ownership data response. As discussed with respect to claim 2, Arimilli does not teach the use of an ownership data response (since no copy of the data is provided with such responses), and all snoop responses mentioned in Arimilli (see Table I of Arimilli) as well as the combined responses (see Table III of Arimilli) are non-data responses. As discussed above, this is because Arimilli's main purpose and teaching relate to arbitrating between conflicting requests to modify data cached in a shared state. For these reasons, Applicant respectfully requests reconsideration and allowance of claim 3.

Regarding claim 4, Arimilli fails to teach that the first node (that received the ownership data response in claim 1) is operative to provide an ownership data response to a second node requesting the data, such that the ordering point migrates from the first node to the second node. As discussed above with respect to claim 3, Arimilli fails to teach both the concept of a cache ordering point and that such a cache ordering point can migrate, as recited in claim 4. Accordingly, Applicant respectfully requests reconsideration and allowance of claim 4.

In sharp contrast to claim 5, Arimilli teaches resolving conflicts between shared cache lines which already have copies of the data using a CDP that issues ownership snoop responses granting ownership. Nothing in Arimilli describes the transaction issued by the agent as being a source broadcast request. Instead, the transaction is described as either a request for ownership of shared cache line, such as may be either a shared state or a shared-owner state. See Arimilli at FIGS. 3A-3B and corresponding description. For example, in the context of Arimilli, why would the system in Arimilli issue a read request for data that

already resides in its cache? For these reasons, Arimilli fails to disclose claim 5. Accordingly, Applicant respectfully requests withdrawal of the rejection of claim 5 as well as claims 6 and 7 that depend from claim 5.

Claim 8 has been amended to make explicit that which was previously implicit and consistent with amended claim 1. In contrast to amended claim 8, Arimilli fails to disclose that any response might indicate that migration of the copy of the data to the first node is in progress. As discussed above with respect to claim 1, no copy of the data migrates to the first agent since the data is already cached in the shared state. Additionally, the second response relied on in rejecting claim 1 (during the time prior to grant of ownership and after issuing a modifying transaction) is not provided by the first agent but by the current target CDP. See Arimilli at para. [0033]. Accordingly, Applicant requests reconsideration and allowance of claim 8.

Regarding claim 9, Arimilli fails to teach that a second node is operative to employ a copy of the data received from a third node for only a single use. The Office Action seems to misread what is claimed, suggesting that coherency protocols typically require only a single agent can own each line at a given time for purposes of modification. However, claim 9 does not recite the second node "owns" the copy of data received from a third node as appears to be suggested in the Office Action. While Arimilli may state that only a single agent can own each cache line for purposes of modification, Arimilli is likewise is silent regarding employing a copy of data for a single use, as recited in claim 9. Accordingly, Applicant respectfully requests reconsideration and allowance of claim 9.

Claim 16 has been amended to recite *inter alia* that a source processor node provides a source broadcast read request for a copy of the data. Amended claim 16 also recites that a data response transfers the copy of the data and a cache ordering point for the data to the source processor node. The Office Action contends that the Arimilli discloses what is recited

in claim 16. However, similar to as discussed with respect to claim 1, Arimilli fails to teach that a source processor provides a source broadcast read request for a copy of data. In sharp contrast, Arimilli teaches a system and method for resolving conflicts between requests to modify a shared cache line. See, *e.g.*, Arimilli's Abstract. Therefore, as discussed above, an agent in the system of Arimilli would not provide a source broadcast requests for data which already resides in a cache line of that agent. See Arimilli, Abstract, and at para. [0012].

Furthermore, Arimilli fails to teach the source processor node issues an invalidate line command to other processor nodes of the system in response to receiving a data response that transfers the copy of the data (requested in the source broadcast read request) and a cache ordering point for the data to the source processor node. In sharp contrast, Arimilli teaches that the data is already in a shared state at the first agent, such that no data response (which transfers the copy of data and a cache ordering point) would be received in response to the transaction issued by the agent. See Arimilli at para. [0012] and [0033] to [0038]. That is, the combined response from the CDP that transfers ownership is not a data response. See table III of Arimilli. Moreover, Arimilli fails to teach or even suggest that a cache ordering point is transferred. For these reasons and for those reasons discussed above with respect to claim 1, Arimilli fails to teach claim 16. Accordingly, Applicant respectfully requests reconsideration and allowance of claim 16 as well as claims 17-24 that depend from claim 16.

Regarding claim 18, Arimilli fails to teach that the first processor node is operative to provide a first conflict response to source broadcast requests for the data from other processor nodes prior to receiving the data response that transfers the ordering point for the data to the source processor node, as recited in claim 18. Instead, the approach taken in Arimilli explicitly employs a CDP, which is not part of the processor complex or agent, that provides snoop responses to deny ownership to conflicting transactions during the interval from issuing a transaction to modify a shared cache line until the agent is informed of the grant of

ownership. Arimilli, at page 4, para. [0033]. Since Arimilli fails to teach claim 18, Applicant respectfully requests reconsideration and allowance of claim 18 and claims 19-24, which depend from claim 18.

Similar to as discussed above with respect to claims 1 and 18 , Arimilli fails to teach that an agent (or a processor complex 10) provides any response to source broadcast requests for the data from other nodes, especially not source broadcast read requests, as recited in claim 19. Instead, the approach in Arimilli utilizes the CDP to protect ownership during the interim until ownership as been granted to the agent issuing the transaction. See Arimilli at para. [0033] as well as the details provided at para. [0035]-[0038]. Accordingly, Applicant respectfully requests reconsideration and allowance of claim 19.

Claim 21 has been amended to correct an inadvertent typographical error and to be consistent with the amendment to claim 16. The Office Action contends that Arimilli discloses claim 21. We respectfully disagree with this contention. Instead, the Office Action appears to have mischaracterized the reference. Arimilli teaches that the state of the target cache line recorded in the cache directory is a shared-owner state. While master 26 is issuing kill transactions, the associated snooper 28 provides NACK snoop responses." However, claim 21 recites that the source processor node provides the second response to the source broadcast request for the data after migration of the copy of the data to the source processor node has begun. As queried above: Why would data be migrating to the source processor node if the target cache line is already in a shared-owner state at the node? There simply is no basis to construe Arimilli as disclosing what is recited in claim 21. Accordingly, Applicant respectfully requests reconsideration and allowance of claim 21.

Claims 22 and 20 are patentable for reasons similar to those to stated in support of claim 9, as Arimilli fails to teach that a second node being operative to employ a copy of the

data received from a third node for only a single use. Reconsideration and allowance of claims 22 and 29 are respectfully requested.

Arimilli fails to teach or suggest claim 25 for at substantially similar reasons to those given in support of claims 16. Therefore, Arimilli fails to teach each and every element of claim 25. Accordingly, Applicant respectfully requests reconsideration and allowance of claim 25 as well as claims 26-30 which depend from claim 25.

For reasons similar to those given in support of claims 16 and 18, Arimilli fails to disclose claim 26. Since Arimilli fails to teach each and every element of claim 26, Applicant respectfully requests reconsideration and allowance of claim 26.

Claim 27 has been amended to correct an inadvertent typographical error. Claims 27 and 28 are patentable over Arimilli for similar reasons to those stated above with respect to claims 6 and 20. Accordingly, Applicant respectfully requests reconsideration and allowance of claims 27 and 28.

Claim 31 has been amended to recite that which was previously implicit, namely, that the ownership data response comprises a copy of the data. Claim 31 has also been amended to recite the means provides the first conflict response from the first node (from which the source broadcast request is broadcast). Claim 31 is patentable over Arimilli for similar reasons to the reasons provided in support of claim 1. For example, as stated in support of claim 1, Arimilli fails to teach means for broadcasting a source broadcast request for data from a first node. Instead Arimilli teaches a snooping transaction on the interconnect and that a CDP provides a snoop response granting ownership of the data to the requesting agent. See Arimilli para. [0012]. Moreover, Arimilli fails to teach any means for providing from the first node a first conflict response to other source broadcast requests for the data from other nodes while the source broadcast for the data is pending at the first node. As discussed supra, this is because the first node in Arimilli already has the data in a shared state and the granting

CDP (not the agent or processor complex issuing the transaction) protects ownership by issuing snoop responses until the agent receives grant of ownership. See Arimilli at para. [0033]. Arimilli also fails to teach an ownership data response at the first node (an ownership response also comprising a copy of the data), again because data associated with a target address is cached at a first agent in a shared cache state. For these reasons, Applicant respectfully requests reconsideration and allowance of amended claim 31 as well as claims 32 and 33 that depend from claim 31. Additionally, since Arimilli fails to teach a system employing an ownership data response, as set forth in claims 32 and 33, Arimilli consequently also fails to teach the respective means introduced in such claims.

Claim 34 has been amended to recite that a line of data and a cache ordering point for the line of data are migrated from a first node of a system to a second node of the system. For reasons similar to those given in support of claim 1, Arimilli fails to disclose the method of amended claim 34. For example, Arimilli teaches that data associated with a target address are cached at the first agent among the plurality of agents in a shared state. However, Arimilli fails to teach migrating a line of data and a cache ordering point for the line of data from a first node to a second node of the system because the line of data is already in the first agent. As discussed above with respect to claim 1 and other claims, Arimilli fails to disclose migrating a line of data because it focuses on arbitrating between conflicting requests to modify data that is cached in a shared state. See Abstract of Arimilli. Additionally, as discussed above with respect to claim 3, Arimilli does not teach or even suggest migration of a cache ordering point, as recited in claim 34. Accordingly, Applicant respectfully requests reconsideration and allowance of claim 34 as well as claims 35-38 that depend from claim 34.

Applicant respectfully requests reconsideration and allowance of claim 35 for reasons similar to those given in support of claims 18 and 34.

Regarding claim 36, Arimilli fails to teach enabling a shared copy of the data to be filled at one of the other nodes of the system. Instead, Arimilli teaches granting ownership of data in a shared cache in order to modify the shared copy. As stated in the Office Action (at page 15, lines 3-4), the first agent invalidates other cached copies of the data. Moreover, there is nothing in Arimilli that teaches that a copy of data would be filled in response to receiving the first conflict response and a data response. First, as discussed herein, since the target data is shared, another agent would not be receiving a data response such that no data would be filled, consistent to what is recited in claim 36. Similarly, Arimilli is silent on enabling a copy of a line of data from system memory to be filled at another node, as recited in claim 36. For these reasons, Applicant requests withdrawal of the rejection of claim 36.

Claim 37 is patentable for at least reasons similar to those stated in support of claims 9 and 35.

Claim 39 is patentable for at least reasons similar to those stated in support of claims 1 and 31.

The Office Action relies on the grounds for rejecting claim 34 as the basis for the rejection of claim 40. We respectfully disagree that this rationale supports the contention that Arimilli anticipates claim 40. For reasons similar to those given in support of claim 1, Arimilli fails to disclose the computer system recited in claim 40. For example, Arimilli teaches that data associated with a target address are cached at a first agent among the plurality of agents in a shared state, such that the first agent would not receive migratory data in response to the transaction issued. Instead, as discussed with respect to claim 1, since the data is cached, ownership is transferred to the first agent by a non-data ownership response. See Arimilli at para. [0012] and Table III, in which the target CDP provides the combined response to allow the requesting master to modify the cache line. However, Arimilli fails to teach source broadcast read requests for a line of data by the source node because the line of

data is already cached in the first agent (i.e., in the shared state). Therefore, Arimilli fails to disclose claim 40 as is being suggested in the Office Action. Accordingly, Applicant respectfully requests reconsideration and allowance of claim 40.

III. **Rejection of Claims 10-11, 23-24, 30 and 38 under 35 U.S.C. 103(a)**

Claims 10-11, 23-24, 30 and 38 have been rejected under 35 U.S.C. 103(a) as being unpatentable over Arimilli, in view of U.S. Patent Publication No. 6,138218, to Arimilli, et al. ("Arimilli '218"). Applicant traverses this rejection for the following reasons.

The Office Action admits that Arimilli fails to disclose "the second node being operative to employ a forward progress technique to obtain the data. At least for the reasons stated in support of claim 8, Arimilli also fails to teach or suggest dependent claim 10. For example, Arimilli fails to teach or suggest other source broadcast requests for the data or that the second node is operative to obtain the data. Arimilli '218 fails to cure the deficiencies of Arimilli in teaching claim 10. Since Arimilli teaches scenarios when the first agent issuing the transaction already has the target cache line in a shared state at the first agent, one of ordinary skill would not be motivated to use a forward progress protocol to obtain the data as taught by Arimilli '218, as is being suggested in the Office Action. That is, since the data is already cached, there appears insufficient motivation to employ a forward progress technique, as suggested in the Office Action, based on the teachings of Arimilli '218. For these reasons, one of ordinary skill in the art would not be motivated to combine Arimilli with the forward progress protocol of Arimilli 218 to create the system of claim 10. Accordingly, Applicant respectfully requests reconsideration and allowance of claim 10, as well as claim 11 which depends from claim 10.

Claims 23, 30 and 38 are patentable for substantially similar reasons to those identified above with respect to claim 10 and for the reasons discussed relative to the respective claims from which they depend.

Additionally, regarding claims 11 and 24, Applicant submits that Arimilli '218 fails to disclose the action intended to achieve forward progress would include a forward progress cache coherency protocol, such that it would not be obvious to create the system of either claims 11 or 24 based on the combined teachings of Arimilli and Arimilli '218. Instead, Arimilli '218 teaches that action intended to achieve forward progress might include a push operation or an alteration of coherency state. See Arimilli '218 at Col. 6, lines 60-63. Accordingly, Applicant respectfully requests reconsideration and allowance of claims 11 and 24.

IV. Rejection of Claim 15 under 35 U.S.C. 103(a)

Claim 15 has been rejected under 35 U.S.C. 103(a) as being over Arimilli, in view of U.S. Arimilli 218 and U.S. Patent Publication No. 6,883,070 to Martin et al. ("Martin"). Applicant traverses this rejection for the following reasons.

The Office Action contends that Arimilli, in view of Arimilli 218 and Martin disclose claim 15. We disagree with this contention. For at least the reasons given in support of claims 1 and 10, the purported combination fails to disclose claim 15. The addition of Martin to Arimilli and Arimilli '218 does not cure the deficiencies of the prior combination. For example, while Martin may disclose that different protocols can be utilized, Martin teaches that different protocols are utilized depending on bandwidth requirements of the system. See Martin's Abstract. There is nothing to suggest, however, that a node in the system of Martin would employ a source broadcast-based protocol to issue the source broadcast request and an associated forward progress protocol to reissue a request for such data in response to the

request failing in the source broadcast protocol, as recited in claim 15. That is, Martin, whether taken individually or in combination with Arimilli '218, provides no suggestion of the ability to switch between protocols as recited in claim 15. Accordingly, one of ordinary skill in the art would not be motivated to combine the system of Arimilli with Arimilli '218 and Martin to create the system of claim 15. Applicant submits that the only plausible way to create claim 15 would be to employ improper hindsight based on the teachings of the present application. For these reasons, Applicant respectfully requests reconsideration and allowance of claim 15.

V. CONCLUSION

In view of the foregoing remarks, Applicant respectfully submits that the present application is in condition for allowance. Applicant respectfully requests reconsideration of this application and that the application be passed to issue.

Should the Examiner have any questions concerning this paper, the Examiner is invited and encouraged to contact Applicant's undersigned attorney at (216) 621-2234, Ext. 106.

No additional fees should be due for this response. In the event any fees are due in connection with the filing of this document, the Commissioner is authorized to charge those fees to Deposit Account No. 08-2025.

Respectfully submitted,

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